EFFECTS OF GOVERNMENT FINANCIAL INCENTIVES, ENVIRONMENTAL CONCERNS, AND EV KNOWLEDGE AMONG USERS' ATTITUDE AND PURCHASE INTENTION IN THAILAND

Sunida Piriyapada[1*] and Pisesporn Wasawong[2]

[1]International College, Panyapiwat Institute of Management

[2]Faculty of Applied Arts, Kingmongkut University of Technology North Bangkok

Received: February 6, 2024 / Revised: June 28, 2024 / Accepted: July 10, 2024

Abstract

There is the growing threat of environmental degradation caused by unethical consumer behavior which in turn poses a substantial barrier to the global imperative of sustainable development. Within this context, the heightened adoption of electric vehicles (EVs) emerges as motivated by diverse factors. This research aims to explore the impact of government financial incentives, environmental concern, and knowledge of EVs on the attitudes and purchasing intentions of EV car users in Thailand.

A dataset involving 400 valid questionnaires from potential EV car users throughout Thailand was acquired through a Google online survey. Subsequently, the collected data were analyzed with the use of the Partial Least Squares Structural Equation Modeling (PLS-SEM) technique. The findings of this study indicate positively and significantly connections among government financial incentives, environmental concern, knowledge of EVs, all of which having the most substantial impact directly and indirectly on the attitudes and purchasing intentions of EV car users in Thailand.

The empirical findings offer valuable insights into EV car users, highlighting strategic initiatives for sustainable development in the automotive sector, both in Thailand and globally. In the final part, the proposed recommendations extend to policymakers seeking to promote sustainable transportation practices and marketers aiming to tailor strategies for the growing EV market in Thailand.

Keywords: Government Financial Incentives, Environmental Concerns, Knowledge of EV, Attitude, Purchase Intention

*Corresponding Author

E-mail: sunidaar@hotmail.com

Introduction

Global environmental challenges drive a shift to sustainability, with Electric Vehicles (EVs) at the forefront. Promising to cut carbon emissions and improve air quality, they offer tangible eco-friendly transport (Anwar et al., 2023). In navigating ecological imperatives, EVs play a crucial role in shaping future mobility (Hasan, 2021). In recent years, the global uptake of EVs has surged, drawing attention from consumers, policymakers, and businesses, as evidenced by significant adoption rates. EVs, powered by rechargeable batteries or alternative energy storage, offer quiet, emission-free transportation, contributing to sustainable mobility discussions (Hawkins et al., 2013). This rise mirrors a heightened global awareness of environmental responsibility, propelled by climate change, air pollution, and fossil fuel depletion concerns (Intergovernmental Panel on Climate Change [IPCC], 2018).

In this context, EVs emerge as a promising solution, aiming to mitigate carbon emissions, improve air quality, and promote eco-friendly transportation practices. This introduction sets the stage for a comprehensive exploration of EVs, covering their definition, evolution, environmental benefits, and technological foundations (Salari, 2022). Amid escalating environmental concerns, EVs are reshaping the automotive industry, recognized for their potential to reduce emissions and redefine mobility (Sierzchula et al. 2014).

Several studies have also investigated the individual effects of government incentives, environmental concerns, EV knowledge, and socioeconomic characteristics on attitudes and purchasing intentions toward EVs. However, there is a considerable gap in comprehending their combined impact in Thailand's context. Previous researches predominantly focus on isolated factors, neglecting their interplay. Empirical investigations are needed to explore how government policies, environmental concern, and consumer knowledge interact to shape EV adoption attitudes and intentions. Thus, this study has important implications for understanding the elements that impact EV adoption. It sheds light on the variables driving or delaying the transition to EVs by analyzing the interconnections between government incentives, environmental concerns, EV knowledge, and individual attitudes. Especially, the emphasis on financial incentives, such as tax cuts, emphasizes their importance in encouraging consumers to overcome early cost hurdles and adopt EV technology in Thailand with the aim of stimulating EV demands by equalizing the price of EV and internal combustion engine vehicles.

Furthermore, the inclusion of EV knowledge as a key component emphasizes its significance in impacting attitudes and decisions about EV adoption as a study of Taptagaporn and Haghani (2019) there is a scarcity of research that emphasizes the importance of financial incentives in encouraging EV adoption and gives useful insights for Thai policymakers and industry players.

By filling this research gap, the study contributes comprehensive insights to the

academic discourse on sustainable consumer behavior and offers practical implications for policymakers, industry stakeholders, and marketers navigating the intricate terrain of eco-friendly transportation solutions in Thailand.

Objectives

1. To study the impact of factors affecting the attitude of electric vehicle users in Thailand.

2. To investigate the effect of factors influencing the purchase intention of electric vehicle users in Thailand through attitude.

Literatures Review

In this study, the term "EVs" encompasses particular modes of transportation, including cars and motorcycles, predominantly powered by electricity, utilized for both professional and personal purposes in everyday routines. The researchers aim to investigate the interplay between government incentives, environmental concerns, and user knowledge, and their impact on attitudes and purchase intentions towards electric vehicles.

Literature review is divided into five topics.

Government Financial Incentives

Government financial incentives refer to various monetary or fiscal measures implemented by governments to stimulate specific economic activities, encourage investment, or achieve certain policy objectives. These incentives can take the form of tax breaks, subsidies, grants, loans at preferential rates, or other financial assistance programs (Smith, 2020).

They penalize harmful externalities, transferring funds via green taxes to positive creators, guiding economic activities toward sustainability goals. Stavins (1998) emphasizes policy choice based on externality characteristics and transaction costs. Governments strategically employ taxes, subsidies, or regulations to foster eco-friendly behavior, rectify market failures, and advance green technology sectors. Amid climate focus, incentives, notably for EV adoption, aid environmental goals and economic growth. EV uptake, supported by incentives, reveals policy transformative potential. In conclusion, grounded in environmental economics, government incentives shape behavior for sustainable development. Illustrated by EV promotion, they harmonize economic progress with environmental preservation (Pigou, 1920; Stavins, 1998). In a study conducted by Wang et al. (2021), findings from structural equation modeling analysis involving 261 potential buyers emphasize the heterogeneity in the impact of consumer perceptions regarding financial incentives, information provision policies, and convenience policies on attitudes and purchase intentions towards battery EVs. A research analysed by Xue et al (2023), an examination is undertaken to understand how family electric vehicle ownership moderates the connection between incentive policies and psychosocial value. Analyzing data gathered from a survey of 402 respondents in China, the results indicate that each of the three types

of incentive policies positively influences consumers' intentions to adopt EVs.

Environmental Concerns

Environmental concerns encompass a wide array of issues stemming from human activities that harm the natural world and its ecosystems. These include pollution, climate change, habitat destruction, biodiversity loss, deforestation, and resource depletion. These concerns have profound implications for both current and future generations' well-being (Doe, 2020).

Environmental issues are increasingly prominent in contemporary discourse, reflecting a growing recognition of humanity's impact on the planet. Central to this discussion is the concept of "sustainability", advocating for the balanced integration of economic, social, and environmental factors (Dresner, 2002). Urgent action is needed to decarbonize transportation, aligning with global commitments to mitigate climate change by transitioning from traditional vehicles to electric ones (Axsen et al., 2017). Additionally, biodiversity underscores the interconnectedness of life on Earth and the significance of safeguarding diverse ecosystems to ensure resilience and vital services (CBD, 1992). Simultaneously, environmental justice focuses on equitable engagement of all citizens in environmental decision-making, emphasizing fairness and addressing disproportionate burdens on marginalized communities (Schlosberg, 2004). An article about the impact of environmental concern and attitude on students' purchase intentions for green items at Universitas Muhammadiyah Yogyakarta. Its findings demonstrate the importance of environmental concern and attitude on green product buying intention (Fauzan & Azhar, 2019). Furthermore, Fontes et al. (2021) addressed a green marketing literature gap by investigating the causes of green purchasing behavior. A study found that ecological concern, environmental attitude, behavior, and buying intention all influence green purchases.

Knowledge of Electric Vehicles

Customer knowledge in the context of EVs encompasses the breadth and depth of consumers' understanding, awareness, and familiarity with various aspects of EV technology, features, benefits, and factors essential to their purchasing decisions (Bockarjova & Krol, 2017). Comprehending users' understanding of EVs is essential for advancing sustainable transportation. Users' awareness and perceptions significantly shape their attitudes toward EV adoption, with factors such as charging infrastructure and range anxiety playing pivotal roles (Sierzchula et al., 2014; Gaglione et al., 2021). Economic factors, including upfront costs, operational expenses, and available incentives, represent critical components of consumers' knowledge about EVs (Carley et al., 2013). Environmental consciousness is integral to informing users about the eco-friendly advantages of EVs, emphasizing the sustainability benefits associated with EV adoption, such as reduced emissions and environmental impact (Alanazi, 2023). Additionally, users' technological literacy

affects their comfort level and expectations regarding EV technology, influencing their adoption decisions (Franke et al., 2012). Furthermore, users' knowledge extends to understanding government policies, incentives, and regulatory frameworks, which significantly impact EV adoption rates (Langbroek et al., 2016).

Behavioral Attitude

Attitudes encompass a complex amalgamation of cognitive, affective, and behavioral components that collectively shape individuals' overall perception and stance towards a specific object or concept (Ajzen, 2001). In the context of electric vehicles, these attitudes play a crucial role, significantly influencing decisions to purchase, usage behaviors, and the likelihood of considering environmentally friendly vehicles for future acquisitions. Behavioral attitudes hold particular importance in shaping individual decisions and behaviors, especially in the realm of travel behavior research. Within the field of transportation, Ajzen (1991) denotes behavioral attitude stands as a central element impacting intentions and subsequent actions. For example, Tunçel (2022) addresses the literature gap in Turkey by examining behavioral factors affecting consumers' EV purchase intentions. The findings suggest positive correlations between attitudes, perceived behavioral control, environmental concerns, green trust, and EV purchase intentions. The study contributes insights for sustainable development strategies and serves as a reference for marketing efforts in the EV industry.

Purchase Intention

The term of purchase intention denotes an individual's likelihood or expressed willingness to acquire a specific product or service in the future, as there is a considerable gap identified between intentions and actual action (Hoang et al., 2022). The existing literature primarily focuses on forecasting buy intention rather than examining actual purchasing behavior Moghavvemi et al. (2015). In the EV sector, Degirmenci and Breitner (2017) predict individuals' attitudes and intentions regarding EVs by considering the environmental performance of these vehicles. As Hoang et al. (2022) point out, the current literature in the EV sector is primarily concerned with predicting buy intention rather than examining actual purchase behavior. Specifically, Degirmenci and Breitner (2017) forecast attitudes and intentions toward EVs based on their environmental performance, Habich-Sobiegalla et al. (2018) investigate EV purchase intention, and Ju and Kim (2022) investigate millennial resistance to EVs in Korean and American markets. Salari (2022) contends that societal norms have an important role in promoting purchase intention. As a result, knowing the elements that influence purchase intention is critical to the EV industry's success, especially in emerging markets (Hoang et al., 2022).

Methodology

This study utilized a quantitative approach to investigate how government financial incentives, environmental concerns,

and knowledge about EV impact the attitudes and purchasing intentions of potential EV car buyers. To achieve this goal, individuals interested in purchasing EVs were invited to participate in an online survey. The sample group comprised potential EV buyers from diverse demographic backgrounds, including various age groups, income levels, educational backgrounds, and geographic locations in Thailand. The survey included questions about their demographic information, EV car consumption patterns, and inquiries related to pertinent variables.

A five-point Likert scale, ranging from 1 to 5 was employed in the study, with values representing the continuum from strongly disagree to strongly agree. To enhance validity, a group of academics revised the survey instrument based on feedback received during 40 pioneer samples. The questionnaire was then refined and restructured to improve its clarity and comprehensibility for the next step of data collecting.

Due to unknown population, the sample calculated according to Cochran (1977) was used. As for the sampling methodology, this study adopted a randomly convenience approach to reach the targeted sample via google form. The intended participants were potential EV car users. Consequently, 400 samples participated in the study.

Validity and reliability are pivotal considerations when selecting research instruments for variable measurement. In this study, Cronbach's alpha serves as a commonly cited statistic to demonstrate the reliability of tests and scales utilized. Content validity was the primary method employed to evaluate validity, ensuring comprehensive coverage of relevant constructs and content areas within the survey instrument when collecting both pioneer test and valid data.

Rigorous validation procedures were applied to verify the completeness and appropriateness of all collected responses for subsequent analysis descriptive statistics, like frequency and percentage, summarize categorical variable distribution, indicating category occurrence as proportions of the total sample, while correlation analysis evaluates variable correlations, indicating strength and direction, which aids in comprehending data patterns.

To carry out the investigation, a statistical technique known as Partial Least Squares (PLS) modeling was used. This modeling technique is used to investigate correlations between observable variables, notably in the context of Structural Equation Modeling (SEM) and multivariable analysis. PLS is used in cases requiring complex models with a large number of variables or when the dataset does not fully fit to the assumptions of traditional approaches such as covariance-based SEM (Hair et al., 2016; Alqirem et al., 2018).

The study's hypotheses drew from an extensive literature review on EV adoption and consumer behavior, supported by prior research findings and theoretical frameworks (Sovacool & Axsen, 2018; Zhang et al., 2019; Axsen & Sovacool, 2013).

Figure 1 visually represents the hypotheses in this research.

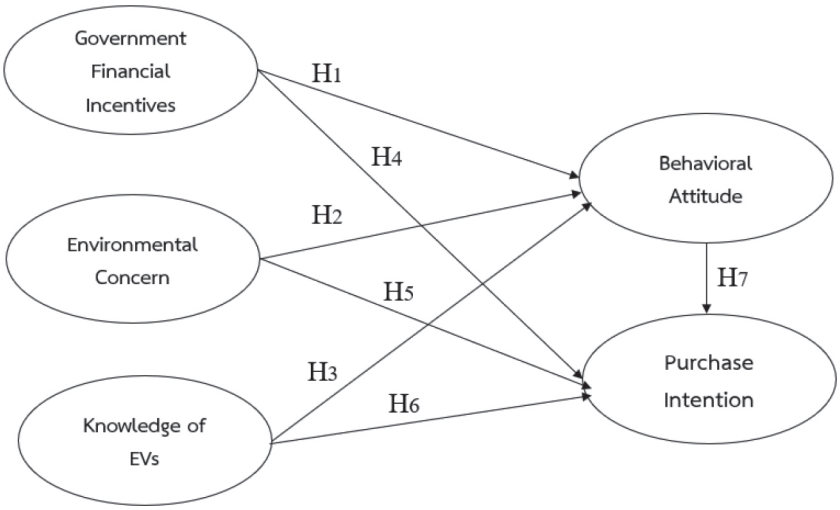

Figure 1 Hypotheses in this study

H_1 Government financial incentive affects behavioral attitude

H_2 Environmental concern affects behavioral attitude

H_3 Knowledge of EVs affects behavioral attitudes

H_4 Government financial incentive affects purchase intention

H_5 Environmental concern affects purchase intention

H_6 Knowledge of EVs affects purchase intention

H_7 Behavioral attitudes affect purchase intention

Results

This section provides a comprehensive examination of the demographic characteristics of the respondents, as obtained through the questionnaire survey as shown in table 1. According to the findings, almost 54% of the overall respondents were female, followed by the male respondents (32.95). Additionally, the majority, comprising 160 of the total respondents, fall within the age range of 25-34 years old (40.11%). Subsequently, the age group of 18-24 years old accounts for 31.64 % or 127 of the surveyed population. While 203 respondents were never been married (50.85%), followed by married living with a partner (33.33%). For occupation, 268 respondents are full-time working (67.05%), followed by part-time work (16.48%). The predominant cohort held a bachelor's degree, constituting 65.25% of the total respondents. Next, respondents with a below bachelor's degree comprised 24.00% of the surveyed population.

Table 1 Demographic Profile

Category	Frequency	Percent
Gender		
Male	132	32.95
Female	214	53.41
Non-binary / Third gender	36	9.09
Prefer not to say	18	4.55
Total	**400**	**100.00**
Age		
Under 18	38	9.60
18-24 years old	127	31.64
25-34 years old	160	40.11
35-44 years old	66	16.38
45-54 years old	7	1.69
55-64 years old	2	0.56
Total	**400**	**100.00**
Marital Status		
Married living with a partner	133	33.33
Widowed divorced	50	12.43
Separated	14	3.39
Never been married	203	50.85
Total	**400**	**100.00**
Occupation		
Working full-time	268	67.05
Working part-time	66	16.48
Unemployed and looking for work	48	11.93
A homemaker or stay-at-home parent	11	2.84
Student	5	1.14
Others	2	0.57
Total	**400**	**100.00**
Education		
Below bachelor’s degree	96	24.00
Bachelor’s degree	261	65.25
Higher bachelor’s degree	43	10.75
Total	**400**	**100.00**

PLS Measurement (Outer) Model Results

In the initial phase of evaluating the PLS outer model, a thorough analysis of item loadings is undertaken to investigate the correlations between latent variables and their reflective indicators. Notably, a significant majority of items exceed the established threshold of 0.6, affirming their commendable reliability. All items have surpassed the 0.6 threshold, indicating the reliability of the items. As a result, a total of 20 survey items are affirmed as valid measures for both dependent and independent variables, as outlined in Table 2. Another parameter for evaluating the quality of an item involves the examination of its construct validity. This assessment aims to establish the accuracy of the selected measures in truly capturing the intended constructs and faithfully representing the associated constructs (Hair et al., 2016).

Table 2 Item Loadings

Constructs		ATT	ENV	GFI	KEV	PUR
ATT1	I believe that EVs is a good thing, beneficial and attractive.	0.944				
ATT2	It's smart for the government to try to get more people to use EVs.	0.937				
ATT3	I think it's a good idea to use EVs.	0.941				
ENV1	I am very concerned about the environment.		0.886			
ENV2	I think individuals have a responsibility to protect the environment.		0.940			
ENV3	I consider the environmental issue when making a purchase.		0.933			
ENV4	I am willing to make sacrifices to protect the environment.		0.932			
GFI1	Overall, financial benefits make it easier for me to buy EVs.			0.890		
GFI2	Purchase subsidies help me adopt electric cars.			0.928		
GFI3	Lessening taxes on purchases makes it easier for me to buy an EV.			0.909		
GFI4	Tax reductions aid in EV purchases.			0.898		
GFI5	Government rebates influence my decision to purchase an EV.			0.908		

Table 2 Item Loadings (Con.)

Constructs	ATT	ENV	GFI	KEV	PUR
KEV1 I have little knowledge of EVs.				0.918	
KEV2 I have little experience of EVs.				0.949	
KEV3 I am not familiar with EVs.				0.937	
KEV4 I am largely ignorant of EVs.				0.921	
PUR1 I have a high intention to buy an EV.					0.938
PUR2 I am willing to adopt EVs when choosing a vehicle in the near future.					0.950
PUR3 I plan to adopt EVs when choosing a vehicle in the near future.					0.948
PUR4 I would like to suggest that people who are planning to buy a car get an EV.					0.928

Pearson's correlation coefficient explored the relationships between variable pairs, resulting in coefficients spanning from .220 to .478. Generally, coefficients exceeding 0.5 signal potential multicollinearity, while those surpassing 0.8 indicate stronger associations. Based on this analysis, multicollinearity does not appear to be a significant issue (Moore et al., 2015).

Construct validity is often established by a thorough examination of both convergent and discriminant validity. Hair et al. (2016) define convergent validity as the degree of correlation seen between a certain construct and the measures expressly developed to test it. When the Average Variance Explained (AVE) score meets or exceeds the 0.5 level, convergent validity is validated (Hair et al., 2016). This numerical criterion validates the construct's robust convergent validity (Fornell & Larcker, 1981). As presented in Table 3, the Average Variance Explained (AVE) scores for each construct exceed the critical threshold of 0.5, affirming the presence of convergent validity. An alternative method for assessing convergent validity involves a meticulous examination of composite reliability scores associated with the constructs, as suggested by Fornell and Larcker (1981). Within this analytical framework, all constructs exhibit robust composite reliabilities, surpassing the specified threshold of 0.60 (Hair et al., 2016). Moreover, the evaluation of internal consistency for the constructs entails scrutinizing Cronbach's alpha measures. Satisfactory internal consistency is affirmed when the reliability estimates surpass 0.70, in accordance with the criteria outlined by Hair et al. (2016) and Field (2013). Furthermore, all of the measurements show resilient

reliability estimates, with Cronbach's alpha coefficients exceeding the 0.70 threshold (Hair et al., 2016; Field, 2013). This satisfies the second requirement for determining convergent validity.

Table 3 Reliability and Validity Estimates

Construct	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
ATT	0.935	0.936	0.959	0.885
ENV	0.942	0.945	0.958	0.852
GFI	0.946	0.946	0.958	0.822
KEV	0.949	0.949	0.963	0.868
PUR	0.957	0.957	0.969	0.886

Model Fit Assessment

Examining the model fit indices from Table 4 reveals that the Standardized Root Mean Square Residual (SRMR) stands at 0.071, falling within the recommended range of 0.08 to 0.1 (Hair et al., 2016; Henseler et al., 2016). This value of 0.071 suggests a satisfactory fit, indicating minimal residuals and a precise representation of the data. Another gauge of model fit, the Normed Fit Index (NFI), records a score of 0.921. indicating a good fit for the model, supporting its adequacy (Hair et al., 2019). Therefore, the current model fits the data well Additional metrics pertaining to model fit are furnished in table 4 below.

Table 4 Model Fit Results

Indices	Saturated model	Estimated model
SRMR	0.057	0.071
d_ULS	2.502	5.081
d_G	2.321	0.449
Chi-square	1020.633	1028.654
NFI	0.910	0.921

Next, an examination of the inner structural model of Partial Least Squares (PLS) is carried out to evaluate the importance of the regression paths and the predictive performance of the model. Table 5 presents beta values, along with T-Statistics, P-Values, and the results of hypotheses, as per the work of Chin et al. (2003). Upon analyzing the research model, seven hypotheses have exhibited statistical significance. It is crucial to underscore that, in the current investigation, the most influential pathway is the impact of knowledge of EV on attitude (β = 0.569, t = 11.807, P-value = 0.00). Furthermore, the significance of government financial incentives on attitude is noteworthy (β = 0.218, t = 5.594, P-value = 0.00), along with environmental concern (β = 0.175, t = 3.695, P-value = 0.00). Additionally, knowledge of EV significantly and directly shapes car users' intention to purchase EV cars (β = 0.298, t = 10.481, P value = 0.00), and government financial incentives also positively influence purchase intention (β = 0.141, t = 5.551, P-value = 0.00). However, the least impactful path is the influence of environmental concern on car users' attitudes, which has the lowest impact on the intention to buy an EV car (β = 0.115, t = 3.865, P-value = 0.00). Finally, behavioral attitude has a substantial influence on users' purchasing intention, the associations between the variables were subsequently evaluated utilizing the results obtained as presented in Table 5.

Table 5 Results of Inner Model Testing

Hypothesis	Path Coefficients	t	P values	Hypothesis Result
GFI -> ATT	0.218	5.594	.000	Supported
ENV -> ATT	0.175	3.695	.000	Supported
KEV -> ATT	0.569	11.807	.000	Supported
ENV -> PUR	0.115	3.865	.000	Supported
GFI -> PUR	0.141	5.551	.000	Supported
KEV -> PUR	0.298	10.481	.000	Supported
ATT -> PUR	0.416	44.016	.000	Supported

As a result, all hypotheses receive backing at the 0.001 significance level. The conceptual model, analyzed using SmartPLS 3.0 software, is illustrated in Figure 2.

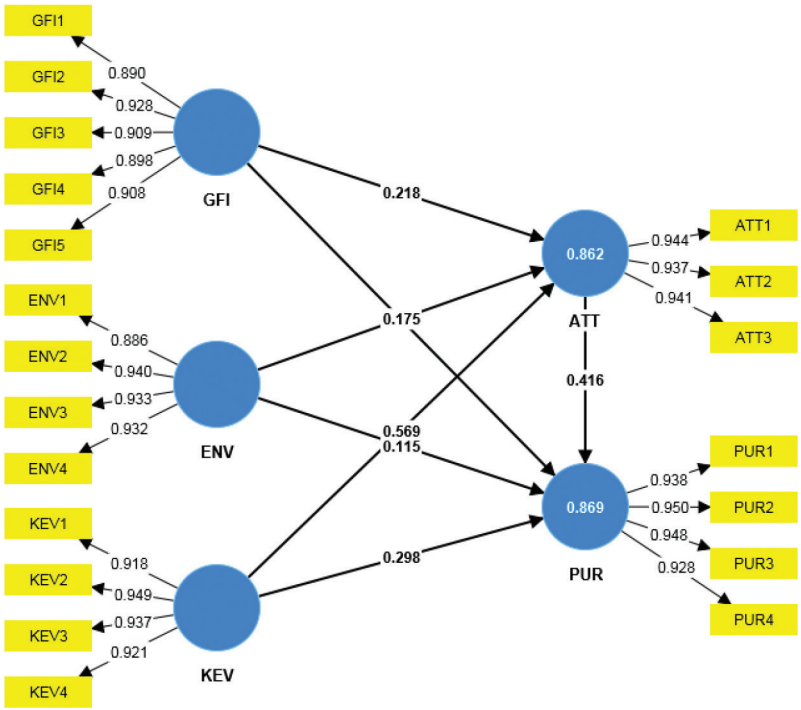

Figure 2 The diagram of results

Discussion

The identification of statistical significance in all seven hypotheses provides notable theoretical contributions to the understanding of factors influencing behavioral attitudes and purchase intentions toward EVs. Each hypothesis corresponds to a distinct factor, and their significance underscores their individual roles in shaping consumer perceptions and behaviors. The theoretical contributions can be summarized as follows:

Government Financial Incentives (H_1 and H_4)

The established significance of H_1 highlights the critical role of government financial incentives in affecting behavioral views. It underlines their critical role in shaping people's perceptions and decisions, particularly regarding the adoption of electric vehicles. As government financial incentives increase, so does the likelihood of adopting positive behavioral attitudes toward EVs. This discovery aligns with earlier studies by authors such as Bigsby et al. (2017), Ansab and Kumar (2022), and Wang et al. (2021). Specifically, concerning the relationship between government financial incentives and purchase intention, the findings are consistent with Wang et al. (2021), who pointed out that financial incentives, information provision policies, and convenience policies impact attitudes and purchase intentions regarding Battery EVs in China. Similarly, Xue (2023) found that all three types of incentive policies positively influence consumers' intentions to purchase EVs. Additionally, Axsen et al. (2015) confirmed the effectiveness of government incentives in promoting EV adoption in North America and assess consumer awareness of these incentives.

The confirmed significance of H_1 and H_4 emphasizes the pivotal role of government financial incentives in influencing both behavioral attitudes and purchase intentions. This underscores the significance of policy measures and incentives in shaping positive consumer perceptions and intentions towards adopting EVs.

Environmental Concern (H_2 and H_5)

The significance of H_2 and H_5 suggests that environmental concern plays a crucial role in shaping both behavioral attitudes and purchase intentions. This contributes to the understanding that consumers who prioritize environmental considerations are likely to exhibit positive attitudes and intentions toward adopting EVs. Specifically, the current hypothesis of H_2 is substantially associated with environmental concern and attitude on students' buying intentions for green commodities at Universitas Muhammadiyah Yogyakarta. The findings support the importance of environmental concern and attitude in shaping the desire to buy environmentally friendly products, which the present research is consistent with the findings of Fauzan and Azhar (2019), as well as, the current study is in line with the findings of Fontes et al. (2021), who discovered that ecological concern, environmental attitude, behavior, and purchase intentions all influence green customer choices. Moreover, Franke et al. (2013) emphasized the role of environmental concern in shaping attitudes toward EVs, particularly in relation to range preferences and usage behavior in Germany.

Knowledge of EVs (H_3 and H_6)

The hypotheses related to H_3 and H_6 underscore the significance of having knowledge about EVs in influencing behavioral attitudes and purchase intentions. This shows that informed customers are more likely to develop positive attitudes and intentions to use EVs, underlining the need of education and awareness efforts. The results are related to Viyaluru et al. (2021), and they imply the impact of knowledge of maintenance and perceived technology on purchase intention of Battery Electric Vehicle (BEV). Moreover, this discovery is connected to the research conducted by Likhith et al. (2022), which reveals that knowledge of EVs in terms of resale value, environmental impact, and charging infrastructure serves as key catalysts for the adoption of EVs. Consequently, it becomes crucial for students to acquire knowledge about EVs and their utilization, aiming to mitigate pollution for a more sustainable future. Further more, the main finding of Hackbarth and Madlener (2013) study is that consumer preferences for EVs are significantly influenced by their understanding of EV technology. This understanding directly impacts consumers' purchase intentions regarding EVs. Therefore, educating consumers about EV technology and its benefits can positively influence their willingness to consider and purchase EVs.

Behavioral Attitudes (H_7)

The significance of H_7 indicates that behavioral attitudes play a crucial role in shaping purchase intentions. This finding emphasizes the sequential nature of the

consumer decision-making process, where positive attitudes contribute significantly to the intention to purchase an EV. This aligns with the findings of Tunçel (2022), who also observed a positive correlation between consumers' attitudes and their intention to purchase EVs (Degirmenci & Breitner, 2017; Hoang et al., 2022)

Path Coefficients

Path Coefficients show the magnitudes of each factor toward the purchasing intentions. It seems that knowledge about EV (KEV) play the most vital role in the model compared with financial incentive and environment concern. This finding show that price is not the biggest concern for EV consumer behavior in Thailand. Note that, this comparison especially for the case of Thailand between the three factors has never been study before or at least cannot be found from the literature review. The finding can lead to the policy implications, especially for prioritizing policy.

Conclusion

This research reveals a notable direct influence of financial incentives, environmental concern, knowledge of EVs and behavioral attitudes on the intention to purchase EVs. Furthermore, it identifies a significant indirect effect of financial incentives, environmental concern, and knowledge of EVs on EV purchasing intention through behavioral attitudes.

Notably, among these factors, knowledge of EVs demonstrates the most substantial impacts both direct and indirect ways. Nonetheless, the study is subject to certain limitations, such as the absence of segmented analyses based on age groups and geographical regions, as well as the omission of qualitative methodologies

Theoretical Implications

This study provides numerous theoretical implications, with its primary contribution centered on enhancing the current understanding of customer intentions and behaviors related to EVs. In this academic report, the implications of key findings from a quantitative investigation are examined. The study delves into the effects of government financial incentives, environmental concerns, and knowledge about EVs on the behavioral attitudes and purchase intentions of potential EV customers in Thailand.

Firstly, in the realm of EVs, this study carries significant theoretical importance, addressing a gap identified in the existing literature regarding consumer behavior. The study stands out by employing consumers in an emerging market like Thailand as its empirical research field. In this context, Liao et al. (2017) stress that consumer behavioral intentions towards EVs exhibit considerable variations across different markets, influenced by factors including the local environment, cultural dynamics, policies, and the stage of the product cycle. Secondly, this study highlights the significance of consumer knowledge about EVs in shaping attitudes and purchase intentions, a perspective supported by Viyaluru et al. (2021) and Likhith et al. (2022).

The study's discovery of the key pathway—EV knowledge's impact on attitude—significantly advances theoretical understanding. It enriches existing frameworks in consumer behavior and EV adoption by highlighting the pivotal role of knowledge in shaping attitudes. This empirical evidence strengthens an understanding of consumer decision-making in sustainable transportation contexts.

Theoretical implications underscore the necessity for educational and awareness initiatives aimed at equipping consumers with information encompassing maintenance, technology, resale value, environmental impact, and charging infrastructure. Such efforts are theorized to play a crucial role in cultivating positive attitudes and intentions towards the adoption of EVs.

Thirdly, this research serves as a valuable foundation for future scholars interested in exploring the EV market in Thailand. It can be positioned as a comparative study, utilizing its findings as grounded variables to bridge existing research gaps. This contributes to the theoretical landscape by providing a robust framework for future investigations, allowing for a more nuanced understanding of the dynamics within the Thai EV market and facilitating meaningful comparisons with other contexts.

Policy Implications

The empirical findings illuminate the profound impact of factors such as government incentives, environmental concerns, and knowledge about EVs on the intentional behaviors of potential EV customers. Consequently, this study holds significant practical implications, summarized as follows.

Firstly, government financial incentives wield a substantial influence on behavioral attitudes and purchase intentions within the EV realm. Strategic managerial policies should center on the promotion and optimization of these incentives to foster EV adoption. By highlighting the advantages of government support, businesses can enhance consumer willingness, contributing to sustainability goals and positioning themselves at the forefront of the growing market for eco-friendly transportation alternatives.

Secondly, recognizing the pivotal influence of environmental concerns on consumer attitudes and purchase intentions towards eco-friendly products, managers are encouraged to seamlessly integrate impactful eco-friendly messaging into their marketing strategies. This integration is indispensable for resonating with environmentally conscious consumers, cultivating positive perceptions, and ultimately guiding sustainable purchasing behavior.

Thirdly, consumer knowledge about EVs shapes behavioral attitudes and purchase intentions. Managerial policies should prioritize educational campaigns. Strategic Marketing Integration is crucial, emphasizing comprehensive campaigns that harmonize government incentives, impactful environmental messaging, and educational content. This approach creates a compelling

narrative for potential EV buyers, fostering a connection and positively influencing attitudes. Aligning with consumers' environmental values positions businesses to capitalize on incentives and drive sustainable choices in the evolving landscape of electric vehicle adoption.

Lastly, when comparing the magnitude of each factor, it found that price is not the biggest issue for EV consumer, but the EV knowledge. This can imply that government should aim for the EV knowledge policy as the flagship policy and apply the financial incentives and environmental concern policies as supporting polices instead. In addition, for creating the specific policy, the detailing studies, for example the exact knowledge or information about the EV and the appropriate channel for knowledge transferring, should be conducted.

Limitations

The study, based on 400 online observations, has certain limitations that should be considered before implementing any policies. Firstly, the observations lack categorization by regions, potentially affecting the nuanced details of policy implementation. Additionally, the study was conducted during the emerging phase of the EV market in Thailand, and considering the dynamic nature of the market, there is a possibility of changes in the future. Another notable limitation is the absence of separate analysis based on factors such as age group and education background, which can significantly influence the impact and policy implications. Lastly, the study primarily relies on quantitative approaches, highlighting the need for future inclusion of qualitative methods to provide a more comprehensive understanding.

Further Studies

While this study brings valuable insights, it is crucial to acknowledge its limitations, presenting opportunities for future research. Firstly, the focus on EV consumers in Thailand, an emerging market, calls for caution in generalizing findings. Future research is encouraged to expand its scope across various markets, comparing outcomes to identify commonalities and variations. Secondly, the next research should diversify its participant pool to include different age groups, socio-economic backgrounds, and cultural contexts. This will offer a more comprehensive understanding of how various segments of the population perceive and engage with EVs. Thirdly, the exclusive reliance on quantitative methods may overlook qualitative insights that can provide a richer understanding of consumer behaviors. Future studies are encouraged to adopt a mixed-methods approach, combining quantitative surveys with in-depth interviews or focus group discussions. This holistic approach will capture both quantitative trends and qualitative nuances, contributing to a more nuanced interpretation of the findings.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology, 52,* 27-58. https://doi.org/10.1146/annurev.psych.52.1.27

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 28*, 1393-1410.

Alanazi, F. (2023). Electric vehicles: Benefits, challenges, and potential solutions for widespread adaptation. *Applied Sciences, 13*, 6016. https://doi.org/10.3390/app13106016

Alqirem, R. M., Alnaimi, H. M., & Shuhaiber, A. (2018). A best-practice model of university students' relationship development: An empirical study. *International Journal of Knowledge Management, 14*(4), 46-67.

Ansab, K. V., & Kumar, S. P. (2022). Influence of government financial incentives on electric car adoption: Empirical evidence from India. *South Asian Journal of Business Studies, 13*(2), 226-243. https://doi.org/10.1108/SAJBS-03-2021-0088

Anwar, M. A., Dhir, A., Jabeen, F., Zhang, Q., & Siddiquei, A. N. (2023). Unconventional green transport innovations in the post-COVID-19 era: A trade-off between green actions and personal health protection. *Journal of Business Research, 155*, 113442. https://doi.org/10.1016/j.jbusres.2022.113442

Axsen, J., Goldberg, S., & Bailey, J. (2015). Regulating green cars in North America: Policy effectiveness and consumer awareness. *Energy Policy, 86,* 199-214.

Axsen, J., Kurani, K. S., & Burke, A. F. (2017). Are batteries ready for plug-in hybrid buyers? *Transport Policy, 57*, 34-46.

Axsen, J., & Sovacool, B. K. (2013). Contextualizing the electric vehicle consumer: Sociodemographic variations in interest and attitudes in the United States. *Transportation Research Part A: Policy and Practice, 49*, 17-26.

Bigsby, E., Seitz, H. H., Halpern, S. D., Volpp, K., & Cappella, J. N. (2017). Estimating acceptability of financial health incentives. *Health Education & Behavior, 44*(4), 513-518.

Bockarjova, M., & Krol, G. (2017). The effect of information provision on willingness-to-pay for electric vehicles: Evidence from a stated preference study in the Netherlands. *Transportation Research Part A: Policy and Practice, 101*, 211-229.

Carley, S., Krause, R., Lane, B., & Graham, J. (2013). Intent to purchase a plug-in electric vehicle: A survey of early impressions in large US cities. *Transportation Research Part D: Transport and Environment, 18*, 39-45. https://doi.org/10.1016/j.trd.2012.09.007

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research, 14*(2), 189-217.

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley & Sons.

Degirmenci, K., & Breitner, M. H. (2017). Consumer purchase intentions for electric vehicles: Is green more important than price and range? *Transportation Research Part D: Transport and Environment, 51*, 250-260. https://doi.org/10.1016/j.trd.2017.01.001

Doe, J. (2020). Environmental concerns: Definitions, causes, and impacts. *Environmental Science & Technology*, *54*(10), 5892-5905.

Dresner, S. (2002). *The principles of sustainability.* Earthscan.

Fauzan, N., & Azhar, F. N. (2019). The influence of environmental concern and environmental attitude on purchase intention towards green products: A case study of college students in Universitas Muhammadiyah Yogyakarta. In *International Conference on Public Organization (ICONPO)* (pp. 1-14). Asia Pacific Society for Public Affairs (APSPA). http://dx.doi.org/10.2139/ssrn.3525917

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications.

Fontes, A., Moreira, B., & Carlos, C. (2021). The influence of ecological concern on green purchase behavior. *Management & Marketing Sciendo, 16*(3), 246-267. https://doi.org/10.2478/mmcks-2021-0015

Franke, T., Neumann, I., Bühler, F., Cocron, P., & Krems, J. F. (2012) Experiencing range in an electric vehicle: Understanding psychological barriers. *Applied Psychology, 61*, 368-391. https://doi.org/10.1111/j.1464-0597.2011.00474.x

Franke, T., Krems, J. F., & Scholz, U. (2013). What drives range preferences in electric vehicle users? *Transport Policy, 29*, 64-71.

Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research, 18*(3), 382-388. https://doi.org/10.2307/3150980

Gaglione, F., Cottrill, C., & Gargiulo, C. (2021). Urban services, pedestrian networks, and behaviors to measure elderly accessibility. *Transportation Research Part D: Transport and Environment, 90*, 102687.

Habich-Sobiegalla, S., Kostka, G., & Anzinger, N. (2018). Electric vehicle purchase intentions of Chinese, Russian, and Brazilian citizens: An international comparative study. *Journal of Cleaner Production, 205*, 188-200. https://doi.org/10.1016/j.jclepro.2018.08.318

Hackbarth, A., & Madlener, R. (2013). Consumer preferences for electric vehicles: A literature review. *Transportation Research Part D: Transport and Environment, 25,* 24-42.

Hair Jr., J. F., Hult, G. T. M., Ring Pradeep le, C., & Sarstedt, M. (2016). *A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Sage Publications.

Hair Jr., J. J., Risher, J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31*(1), 2-24.

Hasan, S. (2021). Assessment of electric vehicle repurchase intention: A survey-based study on the Norwegian EV market. *Transportation Research Interdisciplinary Perspectives, 11*, 100439. https://doi.org.10.1016/j.trip.2021.100439

Hawkins, T., Singh, B., Majeau-Bettez, G., & Strømman, A. (2013). Comparative environmental life cycle assessment of conventional and electric vehicles. *Journal of Industrial Ecology, 17*(1), 53-64. https://doi.org/10.1111/j.1530-9290.2012.00532.x

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management & Data Systems, 116*(1), 2-20.

Hoang, T. T., Pham, T. H., & Vu, T. M. H. (2022). Examining customer purchase decision towards battery electric vehicles in Vietnam market: A combination of self-interested and pro-environmental approach. *Cogent Business & Management, 9*(1), 2141671.

Intergovernmental Panel on Climate Change (IPCC). (2018). *Global warming of 1.5°C.* https://www.ipcc.ch/sr15/

Ju, N., & Kim, S. H. (2022b). Electric vehicle resistance from Korean and American millennials: Environmental concerns and perception. *Transportation Research Part D: Transport and Environment, 109*, 103387.

Langbroek, J. H. M., Franklin, J. P., & Susilo, Y. O. (2016). The effect of policy incentives on electric vehicle adoption. *Energy Policy, 94*, 94-103.

Liao, F., Molin, E., & van Wee, B. (2017). Consumer preferences for electric vehicles: A literature review. *Transportation Research Part A: Policy and Practice, 37*(3), 252-275.

Likhith, B. S., Pratap, K. V. N. R., Padma, T. M., Kalyan, V. S., & Kumar, V. S. (2022). Knowledge and attitude towards electric vehicles among students. *International Journal of All Research Education and Scientific Methods*, *10*(6), 2226.

Moghavvemi, S., Salleh, N. A. M., Sulaiman, A., & Abessi, M. (2015). Effect of external factors on intention–behavior gap. *Behaviour & Information Technology, 34*(12), 1171-1185.

Moore, D. S., McCabe, G. P., & Craig, B. A. (2015). *Introduction to the practice of statistics.* W. H. Freeman.

Pigou, A. C. (1920). *The economics of welfare*. Macmillan.

Salari, N. (2022). Electric vehicles adoption behavior: Synthesizing the technology readiness index with environmentalism values and instrumental attributes. *Transportation Research Policy and Practice, 164*, 60-81.

Schlosberg, D. (2004). Reconceiving environmental justice: Global movements and political theories. *Environmental Politics, 13*(3), 517-540.

Sierzchula, W., Bakker, S., Maat, K., & van Wee, B. (2014). The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Energy Policy, 68*, 183-194.

Smith, J. (2020). Government financial incentives: Definition, types, and economic implications. *Economic Policy Review, 25*(2), 45-63.

Sovacool, B. K., & Axsen, J. (2018). Understanding the diffusion of electric vehicles in national contexts: A critical review of hybrid modeling approaches. *Renewable and Sustainable Energy Reviews, 93*, 158-168.

Stavins, R. N. (1998). What can we learn from the grand policy experiment? Lessons from SO2 allowance trading. *Journal of Economic Perspectives, 12*(3), 69-88.

Taptagaporn, S., & Haghani, A. (2019). Factors affecting adoption and intention to use electric vehicles: A case study of Thailand. *Sustainability, 11*(11), 3219.

Tunçel, N. (2022). Intention to purchase electric vehicles: Evidence from an emerging market. *Research in Transportation Business & Management, 43*, 100764 . https://doi.org/10.1016/j.rtbm.2021.100764

Viyaluru, H. P., Amshala, V. T., & Kadali, B. R. (2021). Does perceived technology and knowledge of maintenance influence purchase intention of BEVs. *Transportation Research Part D: Transport and Environment, 93*, 102759.

Wang, X. -W., Cao, Y. -M., & Zhang, N. (2021). The influences of incentive policy perceptions and consumer social attributes on battery electric vehicle purchase intentions. *Energy Policy, 151*, 112163. https://doi.org/10.1016/j.enpol.2021.112163

Xue, Y., Zhang, Y., Wang, Z., Tian, S., Xiong, Q., & Li, L. Q. (2023). Effects of incentive policies on the purchase intention of electric vehicles in China: Psychosocial value and family ownership. *Energy Policy, 181*, 113732. https://doi.org/10.1016/j.enpol.2023.113732

Zhang, T., Zhang, Y., & Wang, Y. (2019). Factors affecting the adoption of electric vehicles: A literature review. *Transportation Research Part D: Transport and Environment, 71*, 270-285.

Name and Surname: Sunida Piriyapada

Highest Education: Doctor of Management, Dalian University of Technology

Affiliation: Panyapiwat Institute of Management

Field of Expertise: Digital Marketing, Consumer Psychology, Tourism Management, and Micro Economics

Name and Surname: Pisesporn Wasawong
Highest Education: Ph.D. in Economics, Chulalongkorn University
Affiliation: King Mongkut University of Technology North Bangkok
Field of Expertise: International Economics, Industrial Economics, Emerging Counties, Global Investment, and SMEs Development